

Remarks/Arguments:

This is a reply to the office action of November 14.

The examiner observed that claims 1 - 7 should be designated "withdrawn". We have changed the designations above. It is understood that the non-elected species claims may be rejoined if claim generic to them is allowed.

The drawings were objected to because of handwritten changes made during the international stage. We enclose replacement sheets containing Figs. 6A-6C and 7B-7D in which proper lettering has been applied.

The examiner did not consider the references listed in the original information disclosure statement because copies had not been supplied. We therefore submitted a new IDS yesterday, with copies of each foreign reference. It is noted that claims 1 - 15 were found patentable over these references in the International Preliminary Report on Patentability.

The examiner objected to claims 8, 10 and 14 - 16 on formal grounds including antecedent basis. Suitable corrections have been made to those claims above.

Claim 8 has also been amended to recite that the air hammer motor is in the drill casing and exhausts down the splines

Claims 17 and 18 are new. They depend on claim 8, and describe the embodiments illustrated in Figs. 6A - 6C where the exhaust air passes to the upper and lower passages via a short exhaust air passage. Claim 8 on the other hand requires no such exhaust air passage.

Novelty

Claims 8 and 9 were rejected as anticipated by U.S. Patent 5407021 (Kane et al.).

Claim 8 has been amended above to recite that the air hammer motor is in the drill casing and exhausts down the splines; the rejection is traversed, however, on the basis of another claimed feature. Kane et al. does not disclose the following feature of claim 8: “a plurality of upper air passages each opening from a spline in the region of the bit head and each inclined toward the axis of the bit away from the bit head”.

In evaluating Kane et al., the examiner observed that it discloses a downhole hammer drill including:

“.....a drive sub mounted on an air hammer drill casing 32; and a reverse circulation drill bit 42 having a bit shank mounted in splined relation to said drive sub and a bit head adapted to extend below said drive sub, the air hammer motor exhausting down the splines 40/46, an air exhaust passage formed in said bit shank adjacent said bit head and adapted to receive air exhausted at the lower end of the bit shank splines, **an upper air passage 80 intersecting said exhaust air passage** and directing sample accelerating air from said exhaust air passage up a sample recovery bore 54 of said bit, said bit head having at least one lower air passage 74B therethrough and intersecting said exhaust air passage, said lower air passage having a lower end directing air to the cutting face of the bit through an outlet through the side of the bit head communicating with a channel passing from said outlet to the cutting face 44.” [Emphasis added]

The bit disclosed in Kane et al., as clearly illustrated in figure 1, allows air to exhaust the longitudinal passages 74 through lateral passages 80 which discharge into the central passage 54 in an upward direction to create a suction which aids in drawing cuttings through the exhaust holes 56. While the purpose of this configuration is

clearly intended to achieve a similar result to the configuration of the claimed invention, the present invention does so in a fundamentally different way.

First, the presently claimed invention taps air from that exhausted down the splines, rather than requiring the additional passages 74. Secondly, the lateral passages 80 in Kane et al. are perpendicular to the axis and are not inclined to the axis of the bit as required by the claim. The radiused terminal portion of Kane's lateral passages 80, insofar as it directs air up the drill string, does so at the energy expense of turning the flow sharply through a narrow space.

Further, while the arrow in Kane's Fig. 1 implies that the flow is directed principally up the sample recovery bore, it is clear from the drawing that the fluid flow will be mainly across the bore, creating a turbulence detrimental to the vacuum effect at the bit face.

Thus Kane et al. does not disclose the feature which constitutes the improvement of this invention: the upper air passages each open from a spline in the region of the bit head *and each is inclined toward the axis of the bit away from said bit head.*

Nonobviousness

Claims 10 - 16 were rejected as obvious over Kane et al. in view of U.S. publication 2005/0199429 (Terlet et al.). The examiner acknowledged that Kane et al. does not teach a gauge row on the bit, or a dynamic seal to the borehole, but found those elements in Terlet et al. and concluded the combination would have been obvious.

We agree with the examiner's characterization of Terlet et al.; however, that reference does not overcome the deficiencies of Kane et al. noted above inasmuch as it does not suggest or disclose the missing feature of claim 8 – "a plurality of upper air passages

each opening from a spline in the region of the bit head and each inclined toward the axis of the bit away from the bit head”.

We believe that the claims now presented distinguish the invention from the prior art, and that the application is now in condition for allowance.

Respectfully submitted,

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